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(51) INT CL³
F16B 31/02

(52) Domestic classification
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U1S 2055 F2H

(56) Documents cited

GB 1564237	GB 1387969
GB 1559040	GB 1357875
GB 1517657	GB 1330320
GB 1411151	GB 1298095
GB 1398180	GB 0898026

(58) Field of search
F2H

(54) Shear head screws or bolts, or shear head adaptor

(57) A shear head screw 10 (Fig. 3) comprises a first (screw) head 14A and a second head 14B coupled by a shear neck 16 so that the screw can be tightened by the first head 14A until the screw shears at the neck 16 leaving the second head 14B and a threaded stem 12 tightened to a predetermined torque determined by the shear force. The screw thus applied can subsequently be loosened by the second head 14B.

A shear head adaptor 108 (Fig. 19) comprises a socket 112 drivingly engageable with the screw head 106, and a drive head 114 coupled by a shear neck 116 to the socket 112.

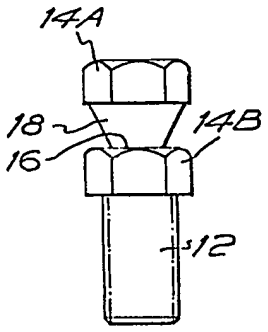

FIG. 3

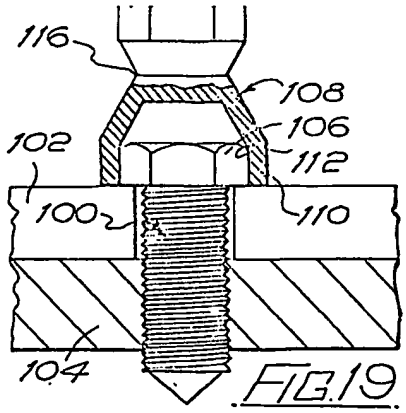

FIG. 19

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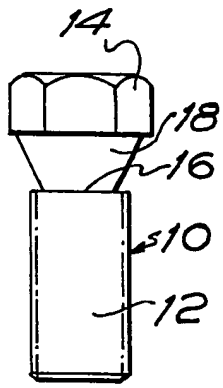

FIG. 1

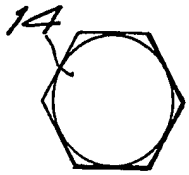

FIG. 2

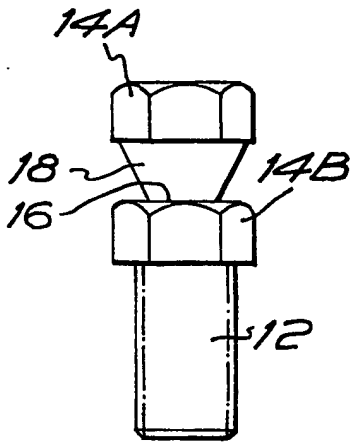

FIG. 3

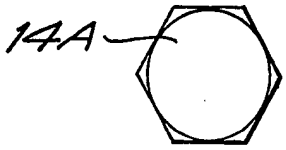

FIG. 4

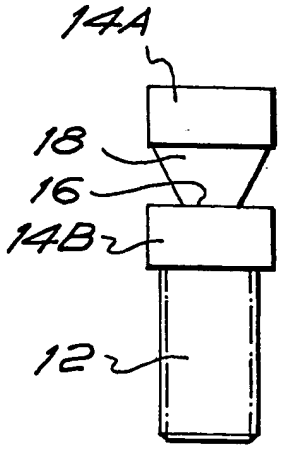

FIG. 5

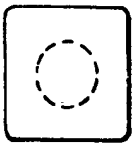

FIG. 6

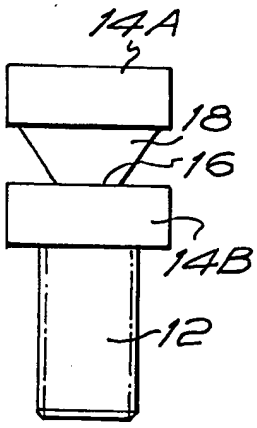

FIG. 7

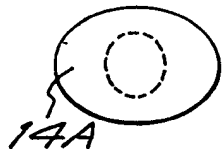

FIG. 8

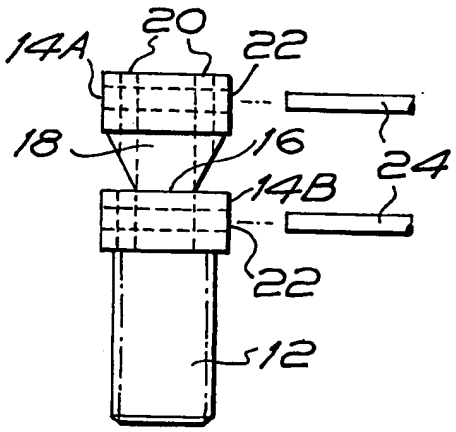

FIG. 9

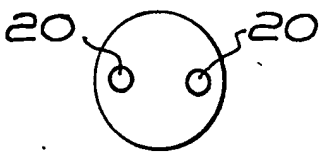

FIG. 10

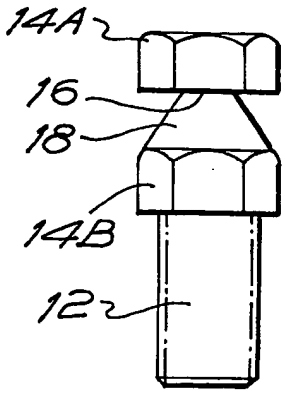

FIG. 11

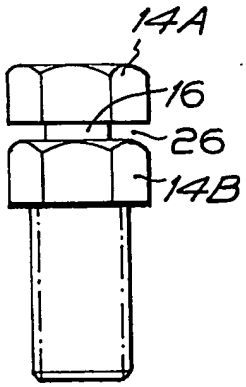

FIG.12

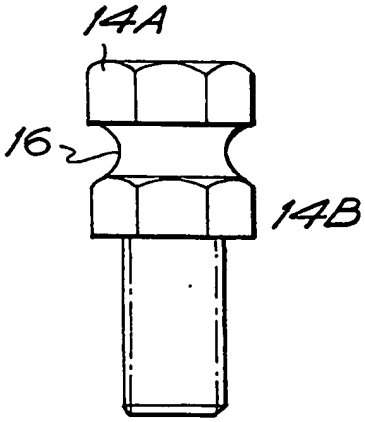

FIG.13

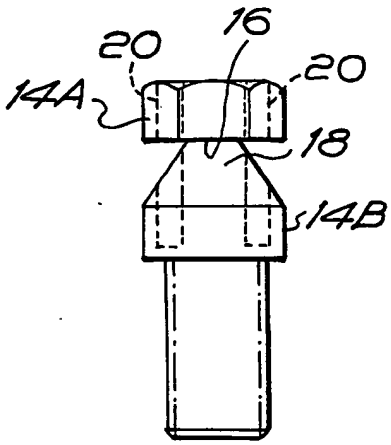

FIG.14

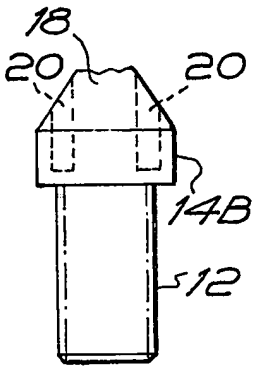

FIG.15

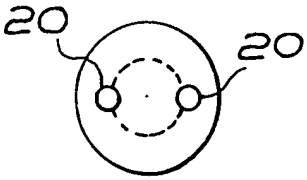

FIG.16

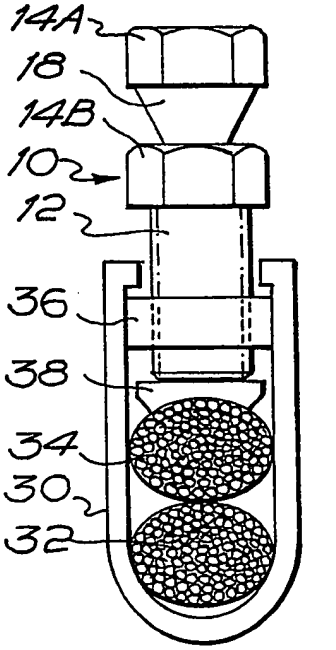

FIG.17

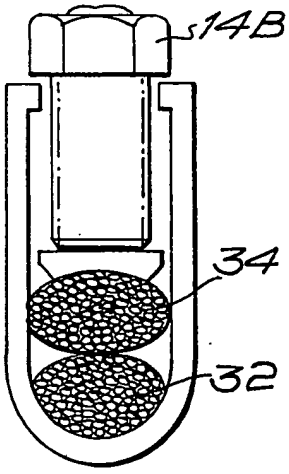

FIG.18

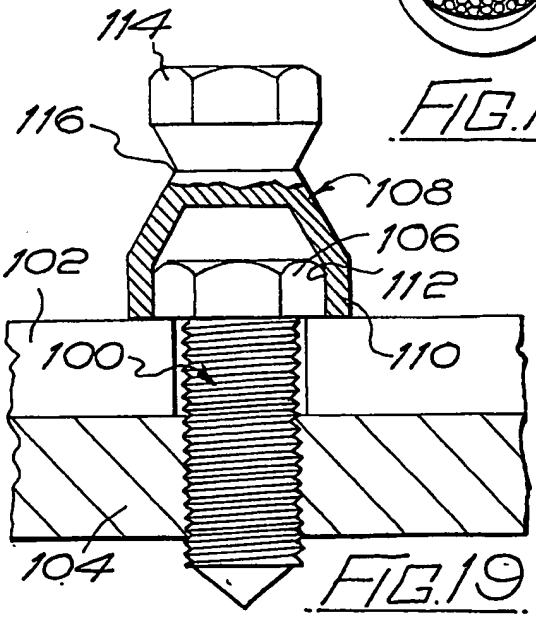

FIG.19

SPECIFICATION

Improvements relating to shear head screws or bolts

This invention relates to shear head screws or bolts, referred to hereinafter simply as shear head screws for convenience, or adaptors therefor, and concerns a novel form of shear head screw or adaptor to provide functionality not heretofore conceived in connection with shear head screws.

Essentially, shear head screws are utilised in circumstances where it is desired to turn a screw, in the tightening of same, to a torque of a predetermined value or lying within a predetermined range, the principle being that the screw is tightened until such times as the head thereof shears from the threaded portion of the screw in a predetermined region, the said region in relation to the screw thread pitch and diameter being designed so that shearing will take place at the predetermined torque.

These shear head screws have a wide application in electrical connectors for the connecting of electrical distribution cables, because in such connectors it is important that the torque applied to the screw which performs the clamping of the connector to another connector or to a connector body should be tightened to a predetermined torque reliably without the use of a torque meter. It is necessary in such application to have a predetermined torque which is neither too high nor too low, because if the torque is too high or too low then the electrical performance of the connector will be reduced unacceptably.

The disadvantage of a shear head screw is that when the head has been sheared from the threaded portion of the screw, it is difficult subsequently to remove the screw. This is not a problem in connection with many electrical connectors of the type referred to above, because such connectors are invariably included in shells or casing which are in any event filled with an encapsulating material such as a synthetic resin, and there is rarely if ever a requirement to disconnect an electrical connector once coupled.

However, the possibility of providing a shear head screw of a type which can be unscrewed represents a significant step forward in certain electrical connectors which are known as terminal connectors which couple supply cables to distribution boards, parts of which require replacement from time to time, but in any event a shear head screw which is capable of being unscrewed represents a considerable advantage in general engineering, because then the screw can be designed to shear at a particular torque, but the shearing of the head does not mean that the screw cannot subsequently be removed. A particularly suitable application for such screws is in internal combustion engines where such screws could be used with good effect for the connecting of the engine cylinder head to the cylinder block.

There is furthermore the general application that if a screw is a shear head screw but is capable of subsequently being unscrewed, then in all engineering applications the screw can be designed so that will prevent the application of screws to more than a predetermined design torque. In many instances in engineering and industry, fitters overtighten screws, causing stripping of the thread, or shearing of the head, with the consequent difficulties of screw removal.

The shear head screw in accordance with the present invention comprises a threaded stem, and at one end of the stem, there are two tool engaging sections for the turning of the screw, the said two sections being an outer section and an inner section as regards their relationship with the threaded stem, such sections being separated by a shear throat designed so that when the screw is turned, the outer section will shear from the remainder of the screw including the second section and threaded stem in the throat area before failure of the screw threaded stem, leaving the screw to be unscrewed by means of a suitable tool which can engage the second section.

Preferably, the said throat will be a reduced diameter region between the first and second sections.

The form of tool to be used in connection with the turning of the screw by engagement of the first and second sections may be any suitable, such as a spanner or socket wrench, and the said sections may be designed so that different tools are required to turn the screw by engagement of the first and second sections.

To achieve any predetermined shear torque at which the first section will shear from the remainder of the screw, will depend upon a number of factors including the material from which the screw is produced, the pitch and diameter of the thread of the threaded portion, and the cross sectional area of the shear throat. Particular screws will of course be designed for particular applications.

The principle of the invention as applied to screws as mentioned above, can also be applied to adaptors, in that an adaptor is drivably coupleable to a screw head, and has another portion which is adapted to be engaged by a tool, and between these portions is a shear area, so that turning of the screw through the medium of the adaptor transmits the torque across the shear area of the adaptor, so that the adaptor will shear at such area when the predetermined torque has been applied to the screw. This means that adaptors can be used with conventional screws, and can tighten same to predetermined torques. In this arrangement, adaptors can be made of different material from the screw being tightened.

Various embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, wherein:-

Figures 1 and *2* are a side elevation and plan of a shear head screw which is used extensively in electrical connectors;

Figures 3 and *4* are views similar to Figures 1 and 2 showing a first embodiment of the invention;

Figures 5 and *6*, *Figures 7* and *8*, and *Figures 9* and *10* show respectively three further embodiments of a shear head screw according to the invention, in a

Figure 11 is a side elevation of a shear head screw according to another embodiment of the invention, showing an alternative formation;

Figures 12 and *13* respectively show, in two further embodiments of the invention, how the throat formation can be modified;

Figure 14 shows a side elevation of a screw according to yet another embodiment of the invention;

Figure 15 shows the screen of Figure 14 after shearing of same;

Figure 16 is a plan view of the shear head screw portion shown in Figure 15;

Figure 17 is a side elevation of an electrical connector showing how the screw according to Figures 3 and 4 is utilised;

Figure 18 shows the connector of Figure 17 after tightening of the screw and shearing of same; and

Figure 19 is a sectional elevation showing an adaptor according to the invention.

Referring to the drawings, where appropriate the same reference numerals, or the same reference numerals with suffix letters have been used throughout.

In Figure 1 there is shown a screw 10 which is of the shear head type in that it is provided with a threaded stem 12, a hexagonal head 14 and a reduced dimension throat 16 forming the shear area of the screw. The throat 16 connects the top of the threaded stem 12 to the head 14 by a frusto-conical section 18. The dimension of the throat 16 is smaller than at least the outer diameter of the thread of stem 12, and will usually be less than the inner diameter of the thread, to ensure that when the screw is tightened, the head 14 will shear from the stem 12 along the shear area 16, at a predetermined torque, which is related to the material of the screw, the diameter and pitch of the thread of stem 12, and the dimension of the throat 16, all of which can be calculated depending upon the application.

Figure 2 shows that the largest cross section of the screw is the head 14, and the screw can be produced from hexagonal bar of the dimension of the head 14.

Screws as shown in Figures 1 and 2 are widely used in electrical connectors as described herein.

The disadvantage of the screw shown in Figures 1 and 2 is that when the head has sheared from the threaded stem, the threaded stem cannot be unscrewed without considerable difficulty. The shear head screws of the present invention are such as to be capable of being unscrewed after the initial shearing has taken place.

In the embodiment of the invention shown in Figure 3, there are two sections 14A and 14B by which the screw can be turned, and the sections 14A and 14B are connected by frusto-conical portion 18 leading from the shear throat 16 located at one side of the section 14B. Figure 4 shows that the screw can be made from hexagonal bar stock. One use of the screw shown in Figures 3 and 4 will be described when referring to Figures 17 and 18.

Figures 5 and 6 show in a manner similar to Figures 3 and 4, a further embodiment of the invention, and illustrate that the sections 14A and Figures 7 and 8 show that the sections 14A and 14B may be oval, in which case a special tool may be required to turn the stem 12 by engaging either the section 14A or the section 14B. Figures 9 and 10 show that the sections 14A and 14B can in fact be circular, in which case the screw may be provided with axial holes 20 passing through both sections 14A and 14B, whereby turning of the screw to shear the section 14A would be by means of a special tool having two pins for engaging the holes 20. Figure 9 also shows that the sections 14A and 14B may be provided with radial holes 22 so that the screw can be turned by engaging either of the holes 22 with tommy bars 24.

In the arrangement of Figure 11, the only difference between this embodiment and the Figures 3 and 4 embodiment is that the section 18 is inverted, so that the shear throat 16 is adjacent to section 14A.

In the arrangement of Figure 12, the throat is defined by a radial slot 26, instead of a frusto-conical section 18, and in the arrangement of Figure 13, the shear section 16 is defined by waisting the section connecting sections 14A and 14B.

In each of the examples described, the shear head screw is applied initially by driving through the section 14A, until the section 14A shears from the remainder at the shear area 16, whereby the screw is tightened to a predetermined torque as indicated herein, and for the removal of the screw, a suitable tool is engaged with the section 14B, and the screw is unscrewed thereby.

As regards the arrangement shown in Figures 14 to 16, the screw illustrated has the first drive section 14A adapted for driving engagement by a tool of a first configuration, whilst the section 14B is such as to require a driving tool of a different configuration for the unscrewing of the screw, and indeed the section 14B is designed so that only a custom built tool will be capable of unscrewing the screw. This embodiment of the invention therefore is particularly effective for security applications where only possessors of the custom built tool can unscrew the screw. Specifically, the section 14A is hexagonal, whilst the section 14B is circular and the frusto-conical section 18 narrows from section 14B to section 14A defining the throat 16 adjacent section 14A. Axial holes 20 extend through the section 14A, the frusto-conical portion 18 and the section 14B as shown, and therefore when the section 14A has been sheared from the remainder as shown in Figure 15, only a tool with a frusto-conical cavity with appropriate drive pins therein can be used for unscrewing of the screw.

Figures 17 and 18 illustrate a typical application of the screw shown in Figures 3 and 4. In Figures 17 and 18, reference 30 indicates a rigid U-shaped, metal yoke, containing two stranded electrical conductors 32 and 34 which are to be electrically connected. The conductor wires are bared and placed in contact as shown, and a screw 10 as shown in Figures 3 and 4 is threaded in a bridge piece 36 and the lower end of the threaded stem 12 engages a pressure pad 38 of the same material as the yoke. To complete the connection, the screw is driven by the

conductors as shown in Figure 18, until the section 14A and the frusto-conical section 18 shear from the remainder of the screw as shown in Figure 18, at the predetermined torque giving a pre-calculated compression between the conductors 32 and 34. To unscrew the screw, it is simply a matter of driving same by the remaining section 14B using the same tool.

When driving a screw of the invention by the outer section 14A, it may be necessary to locate a member around the section 14B, preventing driving engagement between the driving tool and section 14B, to ensure that the tightening torque will be applied through the shear throat area 16.

Shear head screws according to the present invention will have many applications.

Referring now to Figure 19, in this drawing a conventional screw 100 is shown as connecting two components 102 and 104, and mounted on the head 106 of the screw is an adaptor 108 having a socket portion 110 of which a hexagonal socket 112 drivingly engages the head 106 of the screw, and the socket furthermore has a hexagonal drive head 114, the said headed socket being connected by a reduced dimension throat region 116, which forms a shear area enabling the tightening of the screw 100 to a predetermined torque. As will be understood, the adaptor, which is a rigid metallic member, operates in that the screw 106 is tightened by the head 114, using a suitable tool, until such times as the adaptor shears at throat 116, the shearing torque being designed to give predetermined tightening of the screw 100. Other forms of adaptor can be devised, and the advantage of using an adaptor is that it can be made in a different or perhaps cheaper materials, and adaptors can for example be moulded in multiple cavity moulds, whereas screws such as screw 100, or screws 10 of previous embodiments, tend to require machining.

The screws and adaptors according to the invention will normally be fabricated in metal, but the invention is not to be considered limited to such material, as other materials, such as plastics materials can be used.

CLAIMS

1. A shear head screw comprising a threaded stem, and at one end of the stem, there are two tool engaging sections for the turning of the screw, the said two sections being an outer section and an inner section as regards their relationship with the threaded stem, such sections being separated by a shear throat designed so that when the screw is turned, the outer section will shear from the remainder of the screw including the second section and threaded stem in the throat area before failure of the screw threaded stem, leaving the screw to be unscrewed by means of a suitable tool which can engage the second section.

2. A screw according to Claim 1, wherein the throat is a reduced diameter region between the first and second sections.

3. A screw according to Claim 1 or 2, wherein the section and are adapted to be turned by suitable spanners.

4. A screw according to Claim 1, 2 or 3, wherein the throat is defined by the end of a tapered conical section between said inner and outer sections.

5. A screw according to Claim 4, wherein the conical section tapers towards the second section.

6. A shear head adaptor for tightening a screw comprising a first portion which is adapted to be engaged by a tool, and a coupling portion adapted to be coupled drivingly to a screw head, and between these portions is a shear area, so that turning of the screw through the medium of the adaptor transmits the torque across the shear area of the adaptor, so that the adaptor will shear at such area when the predetermined torque has been applied to the screw.

7. An adaptor according to Claim 6, wherein the section which is adapted to be coupled drivingly to a screw head comprises a hexagonal socket for receiving the screw head, and said portion adapted to be turned by a suitable tool comprises a hexagonal sectioned portion.

8. A shear head screw substantially as any of the embodiments described with reference to the accompanying drawings Figures 1 to 18.

9. An adaptor for tightening the screw substantially as hereinbefore described with reference to Figure 19 of the accompanying drawings.

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